AD-A203 065

Target Acquisition and Analysis Training System (TAATS):
Verbal Cue Recognition, Training Readiness and GT Scores as Correlates of Performance with the Basic Combat Vehicle Identification (CVI) Training Program

Gary L. Shope, Norman D. Smith, Otto H. Heuckeroth, and
Stanley F. Bolin
Army Research Institute

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DEC 2 2 1988
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ARI Field Unit at Ford Hood, Texas
George M. Gividen, Jr., Chief

Systems Research Laboratory
Robin L. Keesee, Director

November 1988

United States Army
Research Institute for the Behavioral and Social Sciences

88 12 21 634

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NTIS CRA&I	☑
DTIC TAB	☐
Unannounced	☐
Justification	

By

Distribution

Availability Codes

Dist	Avail and/or Special
A-1	

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION	1b. RESTRICTIVE MARKINGS
Unclassified	- -

2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT
- -	Approved for public release; distribution is unlimited.
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
- -	

4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
ARI Research Note 88-97	- -

6a. NAME OF PERFORMING ORGANIZATION	6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
Army Research Institute Field Unit at Fort Hood, Texas	PERI-SH	- -

6c. ADDRESS (City, State, and ZIP Code)	7b. ADDRESS (City, State, and ZIP Code)
HQ TEXCOM PROV Fort Hood, TX 76544-5065	

8a. NAME OF FUNDING / SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
U.S. Army Research Institute	PERI-SZ	n/a

8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS			
	PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO.
5001 Eisenhower Avenue Alexandria, VA 22333-5600	6.37.39	A795	3.2.1	321H1

11. TITLE (Include Security Classification) Target Acquisition and Analysis Training System(TAATS): Verbal Cue Recognition, Training Readiness, and GT Score as Correlates of Performance with the Basic Combat Vehicle Identification (CVI) Training Program

12. PERSONAL AUTHOR(S)
Gary L. Shope, Norman D. Smith, Otto H. Heuckeroth, and Stanley F. Bolin

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final Report	FROM 82-12 TO 83-12	1988, November	17

16. SUPPLEMENTARY NOTATION
- -

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Combat Vehicle Identification (CVI) Verbal Abilities
			Vehicle Identification Recognition Identification
			Target Acquisition Training Motivation Morale

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This note discusses how within the context of the Target Acquisition and Analysis Training System (TAATS), the Basic Combat Vehicle Identification (CVI) training program was used to gain insight into the influence of GT scores, verbal skills, and morale on vehicle identification performance. Verbal skills were measured with an instrument created for this study, the Verbal Cue Recognition (VCR) Test. Morale was measured with items drawn from the Commander's Unit Analysis Profile (Palmer et al, 1983), and titled the Training Readiness Questionnaire (TRQ)

All soldiers received the same treatment, a standard administration of the Basic CVI Training program following the administration of both the VCR and TRQ tests. A regression model was developed using the VCR test, the TRQ, and the GT for the first sample. Results of the sample indicated that the VCR test, the TRQ and the GT were correlates of performance with the Basic CVI Training Program. A cross-validation of the model, using the second sample was conducted, and the regression model composed of the VCR, TRQ, and GT showed   (OVER)

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
Otto H. Heuckeroth	817/238-1316	PERI-SH

DD Form 1473, JUN 86   Previous editions are obsolete.

ARI RESEARCH NOTE 88-97

19. <u>Abstract</u> (continued)

a weakness as a predictor with the validation sample used.   Further work is required to refine this model.

Keywords:

Target recognition. (SDW)

TARGET ACQUISITION AND ANALYSIS TRAINING SYSTEM (TAATS): VERBAL CUE
RECOGNITION, TRAINING READINESS AND GT SCORE AS CORRELATES OF
PERFORMANCE WITH THE BASIC COMBAT VEHICLE IDENTIFICATION (CVI)
TRAINING PROGRAM

CONTENTS
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INTRODUCTION

Background

The Target Acquisition and Analysis Training System (TAATS), a part of the research program at the Army Research Institute (ARI) Field Unit, Fort Hood, was designed to create coherent development of training in combat vehicle recognition and identification[1]. A series of research and development products have emerged to date from TAATS, including the Basic Combat Vehicle Identification (CVI) Training Program used in this study.

Previous research with training programs in the CVI series has identified a set of soldier characteristics which appear related to performance with CVI training (Smith, Heuckeroth, Warnick & Essig, 1980; Shope, Smith, Heuckeroth, Warnick & Essig, 1981; Heuckeroth, Shope & Smith, 1982). One of the characteristics, the GT score, has consistently been found to be related to performance; soldiers with higher GT scores perform better with a CVI training program.

It was hypothesized that, with a verbally oriented program such as a CVI training program, verbal proficiency might be more directly related to performance than such a general ability measure as GT score. For this reason a test was devised for this research which had as its objective the direct measurement of verbal ability skills needed for this training task.

Moreover, in belief that environmental variables such as general morale should also have an impact on training, an assessment of morale was taken. Items from the Commander's Unit Analysis Profile (CUAP) (Palmer et al, 1984) were chosen which appeared to have face validity and to be positively related to success with a CVI training program.

Military Problem

The ability to recognize and identify vehicles is a skill required of all soldiers. The unit commander is responsible for providing training opportunities to soldiers in the unit which develop this ability. The Basic CVI Training Program is the building block. However, there is great variability among soldiers regarding the time required to train to the current standard. Identification of methods that can be applied which will decrease training time, particularly for less proficient soldiers would, therefore, be of value to the unit commander.

Purpose of this Research

This research examines GT, VCR, and TRQ measures in a regression model to determine their relationship to performance on the Basic CVI Training

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[1]Recognition requires the soldier to discriminate between a threat or friendly vehicle. Identification requires the soldier to give the name or number of the vehicle.

Program. The outcome provides some estimate of the usefulness of:
(a) training related to improving the military vocabulary needed for effective
vehicle identification; (b) identifying aspects of unit environment which
impact on vehicle identification performance.

METHOD

Rationale

In this research, measures believed to be related to task-specific verbal proficiency and general morale, as well as GT score, were examined as correlates of performance with the Basic Combat Vehicle Identification (CVI) Training Program. (A complete description of the CVI program can be found in GTA 17-2-9.) An objective measure of task-specific verbal abilities was taken before the training with a test instrument designed for this study. An assessment of general morale was obtained by selective use of items from a previously developed questionnaire, the Commander's Unit Analysis Profile (CUAP) (Palmer et al, 1984). GT scores were obtained from the units' records. Soldiers were trained on the Basic CVI Training Program in the prescribed manner after being pretested on their existing knowledge of the vehicles involved. The test used was the same posttest taken at the completion of training to assess the effectiveness of the training. The dependent measure used for evaluating performance was the number of correct identification responses on the posttest.

Soldier Participants

Data were collected from 129 male soldiers provided by four units of the 193d Infantry Brigade headquartered at Fort Clayton, Canal Zone, Republic of Panama. Soldiers included in the research were chosen at the discretion of their units. The mean GT score was 104.3, with a standard deviation of 16.3. The modal rank was pay grade E4, with a range from pay grades E1 to E5. Mean time in service was 3.2 years, with a range from 0.3 years to 11.2 years. MOSs represented covered a wide range, as listed in Table 1. This group is referred to hereafter as the "first sample."

Data from another group of soldiers ("second sample") were used to test the reliability of model predictions derived from the first sample. These soldiers were involved in another CVI study with another purpose. Data was obtained from 114 soldiers assigned to combat arms units at Fort Hood, Texas. The mean GT score was 100.4, with a standard deviation of 14.9. The modal rank was pay grade E4, with a range from pay grades E1 to E5. MOSs represented again covered a varied range.

Measurement Instruments

Measures of the soldiers' ability to recognize and identify the 30 test combat vehicles were taken before and after the training through administration of the Final Test, Module 7 of the Basic CVI Training Program. Measures of task-specific verbal proficiency were taken objectively with a verbal recognition task (the Verbal Cue Recognition Test). Readiness to train was assessed using a version of the Commander's Unit Analysis Profile (CUAP) which was originally designed to measure general morale within a unit. GT scores were obtained from unit rosters.

3

CVI Final Test (Module 7) The CVI Final Test Module contains the 30 different vehicles included in the 6 training modules. The 60 slides in this module represent a front view and an oblique view of each of the vehicles in a random sequence. Each vehicle was to be recognized as "friend" or "threat" and identified by vehicle name, e.g., "M1" or "Scimitar" or "ZSU-57-2." Each slide is exposed for 8 seconds.

Table 1

MOS Distribution

MOS	Frequency	Percent
05B	5	3.8
05C	3	2.3
05G	1	0.8
11B	39	30.2
11C	6	4.6
12B	7	5.4
13B	3	2.3
13E	1	0.8
13F	12	9.3
16P	1	0.8
16S	2	1.6
19E	1	0.8
31M	2	1.6
31V	2	1.6
36K	6	4.6
62E	1	0.8
63B	3	2.3
63S	1	0.8
63Y	4	3.1
64C	4	3.1
71L	3	2.3
72E	2	1.6
75B	1	0.8
76W	1	0.8
76Y	4	3.1
91B	12	9.3
91C	1	0.8
98C	1	0.8
Totals	129	100.0

Verbal Cue Recognition Test (VCR) The Verbal Cue Recognition Test was designed for this study to objectively measure the extent soldiers were able to understand parts of vehicles when spoken. The parts selected were significant cues presented in the CVI Training Program. The test consisted of 15 line drawings of 15 different armored vehicles, with 5 different parts numerically labeled on each. Fifteen part names were verbally presented via tape recorder, one for each vehicle, and soldiers were asked to mark the appropriate part on their answer sheets. Through this measurement some understanding of the verbal difficulties causing problems for soldiers were assessed.

Training Readiness Questionnaire (TRQ) The CUAP questionnaire is a unit-evaluation tool developed by the US Army Research Institute (Palmer et al, 1984). It was designed to provide commanders of company-size units a means of identifying current troop attitudes that may detract from or contribute to overall operational effectiveness. Reliability and validation data for this edition of CUAP were collected from approximately 5,000 soldiers stationed in Forces Command and US Army Europe. The questionnaire was designed to be administered to Els through E5s and contains 88 items with 5-point response scales which can be administered in about 15 minutes. The CUAP provides the commander an estimate of the unit's standing in 21 different areas. These areas or factors include such topics as: Unit Cohesiveness; Quality of Training; Officer, NCO, and Immediate Supervisor Leadership; Confidence in Unit; Alcohol/Drug-Related Problems; Race Relations; Job Satisfaction; Promotion Policy; and Morale and Reenlistment Potential. The test/retest reliability, based upon scores of individual respondents, was .78 ($p < .001$). Based upon unit scores (averages) it was .90 ($p < .001$).

This research utilized elements of the CUAP primarily because the items on their face suggest they might tap individual attitudes which may be correlated with performance in a clearly defined learning situation. Fourteen CUAP items were chosen ultimately. Note that the initial work on the CUAP did not seek learning performance correlates.

Procedure

First Sample

Soldiers comprising the first sample (Panama) were trained in four groups in four different locations throughout Panama corresponding to the four units from which they were drawn. All groups were met with every day for a week, Monday through Friday, and received the same treatment, essentially a Basic CVI Training Program. The soldiers attended class each day for about an hour and a half.

Initial data collected on the first day included a pretest to measure the extent soldiers already had some knowledge of the identification of armored vehicles; this pretest was the Module 7 Final Test from the Basic CVI Training Program. An objective measure was taken to assess soldiers' knowledge of the English language as applied to the part description of armored vehicles, the Verbal Cue Recognition Test (VCR). A measure of general morale was taken with the Training Readiness Questionnaire (TRQ).

5

The training modules of the Basic CVI Training Program were administered on Tuesday, Wednesday, and Thursday. The six training modules, Module 1 through Module 6, were administered two each day.

The Module 7 Final Test was administered again on Friday to serve as a posttest evaluating the effectiveness of training.

Second Sample

The second sample (Fort Hood) was run in a similar manner, with a Pretest on Monday, Tuesday through Thursday training, and a Friday Posttest. These data were acquired from another study run for another purpose and were used to cross-validate the findings from sample one.

Analysis

The dependent variable chosen to evaluate performance with the Basic CVI Training Program was the identification response. Previous research (Smith et al, 1980; Heuckeroth et al, 1981; Shope et al, 1981) demonstrated that it is a reliable measure, whereas the recognition response provides a 0.5 probability of being correct when soldiers were merely guessing. The guessing factor with the identification response is nil.

Reliability of the VCR and TRQ test instruments was established using data from sample one in a split-half Pearson product-moment correlation. The relative correlations among GT score, VCR score, and TRQ score were examined with a stepwise multiple regression procedure utilizing both backward and forward selection of variables to be included in the model, i.e., variables already included in the model can be removed on subsequent steps (Hocking, 1976).

Questionnaire Reliabilities

Verbal Cue Recognition (VCR) The split-half reliability procedure using Sample One was used to estimate the reliability of the Verbal Cue Recognition questionnaire. Even numbered items on the questionnaire were split from the odd numbered items, each set of responses were totaled for each soldier, then a correlation run across soldiers for an estimate of the intercorrelation between the two groups of items. A significant correlation was obtained between the two sets of items, r (129) = .67, p < .0001. Using the Spearman-Brown formula[2] to correct the reliability estimate for test length produces r = .80.

Training Readiness Questionaire (TRQ) A similar split-half reliability procedure utilizing data from Sample One was applied to odd and even items from the Training Readiness Questionnaire. When the totaled scores from each group were correlated, a significant correlation was also produced, r (129) = .84, p < .0001. Again using the Spearman-Brown formula the corrected reliability estimate is .91.

Predictability

GT scores were introduced into a regression model along with the VCR and the TRQ as potential predictors of identification performance. The results of this analysis produced the model portrayed in Table 2. The VCR score was the first variable to enter the stepwise regression, with GT score entered in the second step, and the TRQ score the final variable to enter the predictive model. No variables were backed out of the model.

Observed versus Predicted Correlations

First Sample Predicted values for each soldier using TRQ, GT, and VCR were computed beta weights for the model presented in Table 2. Using the weights derived from this computation (.21, .41, & .80), a predicted score was obtained for each soldier by multiplying the weights by the TRQ, GT and VCR scores. A correlation was then run between the predicted scores and the observed score across soldiers. The resultant correlation between the predicted and observed scores was: r (129) = .55, p < .001. This finding indicates that when TRQ, GT and VCR scores were weighted and summed for soldiers, approximately 30% of the variability of predicted scores was in common with vehicle identification performance scores. See Appendix A, Tables 1 and 2 for correlations, means and standard deviations for all variables.

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[2]The Spearman-Brown formula used to obtain the corrected reliability estimate is $r_c = 2r_0 / (1t_{r_0})$, where r_c = corrected estimate and r_0 is the split-half reliability.

Second sample The identical model was used to generate predicted scores
for a second sample for model validation. When a correlation was run between
the observed scores from the second sample and predicted scores produced by the
model from the weights estimated from the first sample, a significant
relationship was found, r (114) = .34, p < .0014. Since shrinkage in the
multiple correlation was expected for the validation sample, the appropriate
test for significance of differences between correlations for the two samples
is a one-tailed Z test. Results of this test indicated Z = 2.03, p <.03. This
finding raises a question over the validity of the model developed for
predicting identification performance generally.[3] See Appendix A, Tables 3 and
4 for sample correlations, means and standard deviations for all variables.

Table 2

Regression Analysis
Weighted Values for TRQ, GT, and VCR Derived from Sample One

	df	MS	F	p
Regression	3	842.50	17.31	.0001
Error	119	48.68		
TOTAL	122			R^2 = .30

Variable	B Value	SS	F	p
Intercept	− 24.01			
TRQ	0.21	274.91	5.65	.02
GT	0.41	512.64	10.53	.002
VCR	0.80	662.25	13.60	.003

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[3] $\underline{Z}$ value was computed by the formula: $\left| Z_{r_1} - Z_{r_2} \right| \left/ \sqrt{\dfrac{1}{N_1 - 3} + \dfrac{1}{N_2 - 3}} \right.$

See McNemar, Q. Psychological Statistics, John Wiley and Sons, Inc. 1962, pp.
139-140. For one-tailed tests, $\left| Z \right| \geq 1.65$ is significant at p < .05.

DISCUSSION

The model showed weakness in its prediction in the validation sample (sample 2) when compared with the model development sample (sample 1). However, given the strength of the VCR variable in sample 1, it is useful to consider it further. Moreover, it is the factor most easily modified in the unit by simply adding a brief training program. The lack of strength in the TRQ variable is consistent with the expectation that attitudinal measures are, at best, subject to extreme variability. In this case, attempting to relate attitudes to a specific performance measure decreases the expectation that a strong relationship would be found. More research is needed to determine if these variables are precursors or merely correlates of CVI performance.

CONCLUSIONS

A regression model was developed using the VCR test, TRQ, and GT for the first sample. Results in the first sample indicated that the VCR test, TRQ and GT were correlates of performance with the Basic CVI Training Program. A cross-validation of the model using the second sample was conducted and the regression model composed of the VCR, TRQ, and GT showed a weakness as a predictor with the validation sample used. Further work is required to refine this model.

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APPENDIX A

Correlations, Means and Standard Deviations
for Both Samples

Table 1

Correlations Coefficients and Probabilities for Sample One

	GT	TRQ	VCR	Observed
GT		-.102 .29 109	.466 .0001 123	.434 .0001 123
TRQ			-.009 .924 115	.198 .034 115
VCR				.452 .0001 129

Table 2

Means and Standard Deviations for Sample One

	N	X	SD
GT	123	104.28	16.39
TRQ	115	42.37	5.63
VCR	129	11.33	3.23
Observed	129	8.42	8.22

Table 3

Correlation Coefficients and Probabilities for Sample Two

	GT	TRQ	VCR	Observed
GT		.206 .061 83	.266 .008 99	.323 .0002 99
TRQ			.112 .276 97	.139 .173 97
VCR				.521 .0001 113

Table 4

Means and Standard Deviations for Sample Two

	$\underline{N}$	$\underline{X}$	$\underline{SD}$
GT	99	98.65	15.08
TRQ	97	45.60	5.65
VCR	113	13.75	1.45
Observed	113	29.18	9.52